**Does Compost make radish plants grow faster?**

This lesson will help students understand the purpose of composting and the uses of composting. Students will design their own experiment, using experimental design principles (constants, control, independent variable, dependent variable and trials) on whether compost makes radish plants grow faster.

Students have been studying various sustainable systems such as hydroponics and the effect of type of liquid on the germination of seeds. Students have been learning about minimizing impacts on the environment by reusing materials and recycling materials. In this investigation, students will work together as a group and design their own experiment. This lesson includes the students as “experts” of composting systems as well as experimental designs.

**Grade Levels:** 8

**Unit**: Human Impact on the Environment Grade 8

How does human consumption of resources impact the environment and our health?

**Topic**: Impact of Human Activities on Plants, Recycling of Materials, Experimental Design

**Standards:**

LE4.1c Most activities in everyday life involve one form of energy being transformed into another.

LE 7.2a In ecosystems, balance is the result of interactions between community members and their environment.

LE7.2b The environment may be altered through the activities of organisms.

CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.7 visually. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed

CCSS.ELA-Literacy.RST.6-8.10 By the end of grade 8, read and comprehends science/technical texts in the grades 6–8 text complexity band independently and proficiently.

**Time**: Four - Five 42 minute periods

**Objectives** : The main objective is for students to design and conduct their own investigation on whether compost helps radish plants grow faster. This lesson involves skills which are higher on Bloom’s taxonomy since the students will be designing their own investigation and then conducting their own experiment using typical experimental design principles. Students will analyze their data, write their findings in a lab report and evaluate the success of their investigations.

By the time students have completed their experiments, students will know experimental design principles in a controlled experiment setting, conduct their own experiment and understand from their own data, whether compost helps radish plants grow faster or slower.

***Differentiation of Lesson*:**

Some students may need more guidance on the formulation of the testable question as well as the specific design of the independent variable, dependent variable, constants, control, hypothesis, trials. For this reason different graphic organizers may be provided to assist these students. As well additional time may be provided to help students with special learning needs.

Some students may prefer to draw out the actual procedure rather than write the steps. This will allow provide those students, who have difficulty in articulating details in writing, an alternative way of presenting the procedure.

Since students are working in groups of four. The following components can be the same for all members: Testable Question, Hypothesis, Trials, Independent Variable, Dependent Variable, Constants, Control, Trials, Materials, Procedure, Data Tables and Data Analysis, List of References. The Introduction and Conclusion should be written on an individual basis.

**Procedure/Methods**

Students will be guided first by reviewing the key minimum requirements of a typical reliable scientific investigation. In groups of four, students will begin to formulate their own hypothesis, based upon prior knowledge of worm bin compost and background information that they have researched.

1. Students will formulate a testable question on compost material and growth of radish plants.
2. Students will formulate a hypothesis based upon their testable question.
3. Students will discuss on the best design for an investigation to answer their testable question. (Are you using plants or seeds? How will you measure growth of a radish plant or seed? What is your control? What are you keeping constant? Where will you place them in the classroom? How are you using the compost? What do you already know about compost?)
4. Students will prepare a list of materials and list of detailed procedural steps.
5. Students will discuss how they will organize the data that they are collecting and in what tabular format.
6. Students will conduct their investigation, collect data and organize the data in tabular format.
7. Students will create other visual displays (graphical representations) of their data.
8. Students will analyze their data and write a summary of their findings using trends and mathematical relationships between the various conditions.
9. Students will prepare a complete lab report as part of the assessment of their understanding of why compost does or does not help radish plants grow. They will make reference to different properties of compost to help explain their findings.

Conclusion Paragraph 1: Students will reiterate whether the data supported or did not support their hypothesis. Explain the data in detail in reference to the reasons why compost did or did not help the radish plants grow.

Conclusion Paragraph 2: Students will explain sources of error in their experimental design and during the investigation. Students will include ways that they could improve the design and the investigation procedure.

Conclusion Paragraph 3: Students will discuss what else they would be interested in studying and the reasons. If they had more time, what other aspects of this investigation, would students like to study.

List of References will be included in the Report

**Materials Needed for This Project**

Compost collected from classroom worm bin or compost received from an ecological group or a botanical garden. Teachers will need to know whether the compost is from an indoor compost bin or an outdoor compost bin.

Radish plants

Radish seeds (some students may prefer to grow the plants from seeds)

Soil

Pots (At least nine per group)

Grow Lab or a location for where the plants will be placed

Water

Measuring tools (graduated cylinders, beakers, measuring spoons)

Ruler

Masking Tape

Markers

Computers

**Conducting The Experiment**

Students will need to remember to:

* Review any safety issues and include them in their report.
* Write down the testable question, hypothesis, trials, independent variable, dependent variable, trials, constants, control, and procedure in a detailed and specific manner so that another person can repeat it.
* Work collaboratively in such a manner that they complete the experimental design and the experiment in a safe and timely fashion.
* Label the pots appropriately with labels you will understand.
* Keep a record of their observations (daily or every other day). Be specific about their observations (quantitative as well as qualitative)
* Write down any mistakes that they do, so that they can include it in their discussion of their findings.

**Assessment**: Students will be assessed based upon the success of working together to design their investigation, writing down the details of their experimental design, conducting their investigation as well as completing a lab report based upon their findings. The Rubric can be found in a separate document.